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AKIN GUMP STRAUSS HAUSER & FELD L.L.P.			LEUNG, JENNIFER A	
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PHILADELPHIA, PA 19103-7013			1764	

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Please find below and/or attached an Office communication concerning this application or proceeding.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment submitted on November 7, 2003 has been received and carefully considered. Claims 2, 5, 7, 11-20 and 22 are cancelled. Claims 27 and 28 have been added. Claims 1, 3, 4, 6, 8-10, 21 and 23-28 remain active.

Response to Arguments

2. Applicant's arguments with respect to the rejection of claims 1, 8, 9, 11, 21 and 26 under 35 U.S.C. 102(b) as being anticipated by Wossner, the rejection of claims 1, 8, 10, 21 and 26 under 35 U.S.C. 102(b) as being anticipated by Fauser, and the rejection of claims 6 and 25 under 35 U.S.C. 103(a) as being unpatentable over Wossner or Fauser (i.e., see pages 7-15 of the response) have been fully considered and are persuasive. Therefore, the rejections have been withdrawn. However, upon further consideration, new grounds of rejection are made in view of newly found prior art references.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 6, 8-10, 21 and 25-28 are rejected under 35 U.S.C. 102(b) as being anticipated by James et al. (US 3,262,758).

Regarding claims 1 and 21, James et al. (FIG. 1, 2; generally, column 2, line 24 to

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column 3, line 60) disclose an apparatus comprising:

a reaction segment having a catalyst bed for oxidizing carbon monoxide (i.e., the annular space

between containers 1 and 8, comprising CO-oxidation bed 22);

a reformed gas inlet (i.e., conduit 6 for introducing primary reformed gas stream 2);

a reformed gas pathway for supplying reformed gas to the reaction segment 22 (i.e., indicated by solid-line flow arrows);

an oxidant gas supplying segment for supplying an oxidant gas to the reformed gas pathway (i.e., conduit 7 for introducing oxygen-containing gas stream 3);

a cooler for cooling an upstream side of the catalyst bed 22 (i.e., the steam boiler section, located between partitions 18 and 19, comprising conduit 13, fire tubes 17 and heat exchange medium supplied via 20 and removed via 21; column 3, lines 25-41); and

means for heating a downstream side of the catalyst bed;

wherein the means comprises a portion of the reformed gas pathway located in proximity to and at least partially surrounding the catalyst bed 22; the means being separated from the catalyst bed 22 by a wall (i.e., inner container wall 8), so as to *inherently* heat the downstream side of the bed 22 by the reformed gas and *inherently* cool the reformed gas in the reformed gas pathway via the transfer of heat energy through wall 8 to the catalyst bed 22, before passing through the cooler, via central conduit 13 and fire tubes 17 (column 1, lines 49-71; column 2, lines 57-70; column 3, lines 14-24 and 41-51).

Regarding claims 6 and 25, James et al. further discloses,

“A stream of oxygen containing gas, such as air, is reacted with the primary reformed gas stream. When ammonia synthesis gas is produced, *a stoichiometric proportion of air is employed* in the secondary reform step to yield a final gas stream containing hydrogen and nitrogen in a 3:1 ratio. The combustion reaction which takes

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place due to oxygen addition *causes a rise in gas stream temperature* and some further conversion of hydrocarbon," (column 1, lines 30-38).

Thus, although a gas flow rate control valve is not illustrated in the figures or explicitly disclosed, such control means would be *inherent* of the apparatus, to enable the disclosed control of a "stoichiometric proportion of air", which will in turn control the "rise in gas stream temperature" and correspond to a rise in the temperature of the catalyst bed 22.

Regarding claims 8 and 26, James et al. (FIG. 1) discloses the reformed gas pathway (see solid-line flow arrows) has a first direction prior to passing through the cooler (i.e. via tube 13) and a second direction passing through the catalyst bed 22, wherein the first and second direction are opposing (column 3, lines 25-52).

Regarding claim 9, James et al. discloses the reaction segment is located outside the reformed gas pathway (i.e., CO-oxidation bed 22 being annular and having a central reformed gas pathway defined by inner container 8; FIG. 1, 2).

Regarding claim 10, James et al. discloses the reaction segment is tube shaped (i.e., annular, CO-oxidation bed 22; FIG. 1) and the reformed gas pathway before the passage through the cooler (i.e. tubes 13, 17) is formed around the reaction segment 22 (i.e., a portion of the gas stream may be *bypassed around the heat exchange section*, passing out of the lower end of conduit 3 via openings controlled by control dampers 14," column 3, lines 14-24).

Regarding claims 27 and 28, James et al. discloses the portion of the reformed gas pathway (i.e., within inner chamber 8) heats the catalyst bed 22 by direct heat transfer through the wall (column 1, lines 49-71; column 2, lines 58-71).

Instant claims 1, 6, 8-10, 21 and 25-28 structurally read on the apparatus of James et al.

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4. Claims 1, 6, 8-10, 21 and 25-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Mieville et al. (US 5,609,832).

Regarding claims 1, 21, 27 and 28, Mieville et al. (FIG. 1; generally, column 4, line 9 to column 5, line 2) discloses an apparatus comprising:

a reaction segment having a catalyst bed for oxidizing carbon monoxide (i.e., converter **22**,

comprising catalyst **24** for catalytically oxidizing exhaust gas hydrocarbons and carbon monoxide; column 4, lines 11-21);

a reformed gas inlet (i.e., gas inlet tube **30**) and a reformed gas pathway (i.e., see solid-line flow arrows, FIG. 1) for supplying reformed gas to the reaction segment **22**;

an oxidant gas supplying segment for supplying an oxidant gas to the reformed gas pathway (i.e., although not shown in FIG. 1, "supplemental oxygen should be provided... after the hydrocarbon-adsorbing portion of the system to ensure effective catalytic conversion of hydrocarbons and carbon monoxide," column 11, lines 26-30)

a cooler for cooling an upstream side of the catalyst bed **24** (i.e., "exhaust gas entering outlet pipe **32** and adsorbent **38** can be cooled further by providing heat-sink structure such as optional fins **50** on the outer surfaces of pipe **32** and/or chamber **39**," column 4, line 53-column 5, line 2); and

means for heating a downstream side of the catalyst bed **24**;

wherein the means comprises a portion of the reformed gas pathway located in proximity to and at least partially surrounding the catalyst bed **24** (i.e., the pathway portion within converter jacket **28**, communicating with open ended heat exchange ducts **26**, column 4, lines 37-52), the means being separated from the catalyst bed **24** by a wall (i.e., the walls defining

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converter **22** and ducts **26**) so as to *inherently* heat the downstream side of the bed **24** by the reformed gas introduced from inlet **30** and *inherently* cool the reformed gas in the reformed gas pathway by direct transfer of heat to catalyst bed **24**, via the walls of converter **22** and ducts **26**, before passing through the cooler **50**.

Regarding claims 6 and 25, Mieville et al. (column 11, lines 14-44) discloses a further embodiment, wherein,

“... the engine could be operated with a *rich air/fuel mixture* which will provide a reductive environment in the channels **124** which will enhance NO_x reduction. Supplemental oxygen should also be provided after the hydrocarbon-adsorbing portion of the system to *ensure effective catalytic conversion* of hydrocarbons and carbon monoxide,” and

“It should be noted that the improved adsorber performance derived from use of heat exchange techniques and improved adsorbent combinations in accordance with the present invention may require *adjustment* of other emissions control equipment... This in turn may require changes such as *providing extra combustion air* during the time the desorbed hydrocarbons reach the catalytically active portion of the emissions system.”

Thus, although a gas flow rate control valve for the oxidant gas supplying segment is not illustrated in the figures or explicitly stated, such control means is *inherent* of the apparatus of Mieville et al., to enable to disclosed ability to control the “air/fuel mixture”, the amount of supplemental oxygen to “ensure effective catalytic conversion”, and the ability to make an “adjustment... providing extra combustion air.” Such control actions will consequently correspond to a control of the temperature of the catalyst bed, as changing amounts of oxygen will *inherently* cause an equilibrium shift in the exothermic, CO-oxidizing reaction.

Regarding claims 8 and 26, Mieville et al. discloses the reformed gas pathway has a first direction prior to passing through the cooler **50** (i.e., as illustrated in FIG. 1, from “left” to

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“right”, via jacket 28) and a second direction passing through the catalyst bed 24 (i.e., as illustrated in FIG. 1, from “right” to “left”, via converter 22), wherein the first and second direction are opposing.

Regarding claim 9, Mieville et al. discloses the reaction segment (comprising catalyst 24) is located outside the reformed gas pathway (i.e., “outside” of the pathway as defined by the portion traversing the open-ended heat exchange ducts 26; FIG. 1).

Regarding claim 10, Mieville et al. discloses the reaction segment is tube shaped (i.e., catalyst 24, packed within tubular-shaped converter 22; FIG. 1) and the reformed gas pathway before the passage through cooler 50 is formed around the reaction segment 24 (i.e., the exhaust gas portion flowing through jacket 28 is disposed around segment 24; FIG. 1).

Instant claims 1, 6, 8-10, 21 and 25-28 structurally read on the apparatus of Mieville et al.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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5. Claims 3, 4, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over James et al. (US 3,262,758) in view of Finnerman et al. (US 3,345,136).

James et al. further discloses that in the CO-oxidation stage, "... the cooled gas stream is passed through *one or more beds of promoted iron oxide catalyst*, in order to react carbon monoxide with steam, thus yielding further hydrogen," (column 1, lines 47-49). However, James et al. is silent as to whether the "one or more beds" may be configured such that an upstream side portion of the catalyst is formed of a different catalyst material than the downstream side portion, and whether the catalyst comprising the downstream portion may exert an activity at a lower temperature than the catalyst material of the upstream side portion.

Finnerman et al. (column 1, lines 34-61) teaches,

"Regardless of the process for which the hydrogen is made, it is generally desirable that it contain a minimum of residual carbon monoxide," and

"To obtain desirably low levels of residual carbon monoxide in the product gas and a corresponding high degree of conversion to hydrogen, the process can be carried out in *two stages*. In the first stage, the carbon monoxide containing gas is contacted in the presence of *a relatively inexpensive shift conversion catalyst active at a relatively high temperatures* to convert the bulk of the carbon monoxide. The exothermic heat of the reaction and a substantial portion of the sensible heat of the partially shifted gas is removed by cooling. The cooled gas is then contacted in the presence of *a relatively more expensive shift conversion catalyst active at a relatively low temperatures* to produce additional hydrogen under equilibrium conditions which favor a low residual proportion of carbon monoxide."

Thus, it would have been obvious for one of ordinary skill in the art at the time the invention was made to select the catalyst configuration as taught by Finnerman et al. for the one or more beds of CO-oxidation catalyst **22** in the apparatus of James et al., because the selection of two catalyst stages, wherein an upstream catalyst stage is active at a relatively high

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temperature and the downstream catalyst stage is active at a relatively low temperature, allows a substantial portion of the carbon monoxide to be converted to carbon dioxide, while producing the desirably low levels of residual carbon monoxide in the product gas and a corresponding high degree of conversion to hydrogen, as taught by Finnerman et al., above.

6. Claims 3, 4, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mieville et al. (US 5,609,832).

Mieville et al. discloses a variety of catalyst material supports, including those comprising metallic material (see column 10, lines 34-52) and further discloses an example wherein, "an embodiment... could be operated with a NO_x-reducing catalyst such as those that contain rhodium, ruthenium or similar metals in channels 124 ahead of absorber portion 126 and a platinum or standard three-way catalyst in channels 124' after adsorber portion 126," (column 11, lines 17-23). Although Mieville et al. is silent as to whether the downstream side portion catalyst may exert an activity at a lower temperature than the catalyst material constituting the upstream side portion, it would have been obvious for one of ordinary skill in the art at the time the invention was made to select catalyst materials having appropriate activity-to-temperature profiles (i.e., catalysts having appropriate "light-off temperatures") for the upstream and downstream portions, respectively, in converter 22 of the apparatus of Mieville et al., on the basis of suitability for the intended use, because the particular catalyst activities selected for each of the upstream and downstream regions would have been considered result effective variables, depending on the particular type of exhaust gas streams purified (i.e., exhaust gas from a lean burn or diesel engine, exhaust gas having a rich air/fuel ratio, a given composition of NO_x or CO, the temperature of exhaust gas exiting the engine manifold, etc.), and where the general

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conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art, *In re Aller*, 105 USPQ 233.

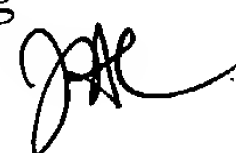
Conclusion

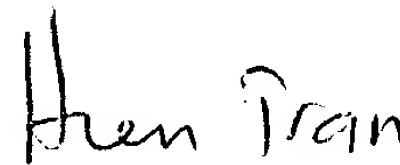
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Leung whose telephone number is (571) 272-1449. The examiner can normally be reached on 8:30 am - 5:30 pm M-F, every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer A. Leung

February 8, 2004 



**HIEN TRAN
PRIMARY EXAMINER**